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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/990,049	11/21/2001	William Ford	450117-03449	1484

20999 7590 04/14/2005

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EXAMINER	
NAFF, DAVID M	

ART UNIT	PAPER NUMBER
1651	

DATE MAILED: 04/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/990,049	FORD ET AL.	
	Examiner	Art Unit	
	David M. Naff	1651	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed, after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *25-47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *25-47* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/7/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/7/05 has been entered.

An amendment of 2/7/05 amended claims 25, 26, 35, 36, 40 and 41.

Claims examined on the merits are 25-47, which are all claims in the application.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 25-47 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

When disclosing binding through an interactive group as in lines 11 and 12 of claim 25, and line 11 of claim 40, the specification discloses only nucleic acid interactive groups attached to the metal complex (page 5, lines 14 and 15, and page 11, line 6).

It is suggested that claim 25 be amended in line 10 after "complex" by inserting --- to said nucleic acid --- and in line 11 after "group" by inserting --- of said complex ---.

Claim 40 should be amended to contain the same type of language as claim 25 by in line 11 before "interactive" inserting --- by binding of said nucleic acid specific metal complex to said nucleic acid through an --, and after "group" inserting --- of said complex ---. Additionally, when an interactive group is present, the specification fails to support both reacting with bases and using an interactive group as encompassed by "and/or" in line 11 of claim 40. It is suggested that "and/or" be replaced with --- or --- as in line 10 of claim 25.

The specification fails to support treating metal nanoparticles within the metal complex-nucleic acid conjugate as now required in claim 35 since according to the specification the metal nanoparticle is contained by the metal nanoparticle-nucleic acid composite. It is suggested that claim 35 be amended by replacing "metal complex-nucleic acid conjugate" in line 2 with --- metal nanoparticle-nucleic acid composite ---.

The specification fails to support a "composite which do and do not having insulating spaces" as now required by claim 41. While the

specification discloses "more or less insulating spaces" (page 7, line 10), it does not disclose spaces as an alternative to no spaces. It is uncertain as to what is mean by "more or less", and this term does not have determinative limits.

It is suggested that claim 41 be changed to be more consistent with the specification by reading --- A nanowire produced by the process of claim 40, wherein the nanowire comprises insulating spaces between individual nanoparticles positioned along a nucleic acid strand of said nucleic acid of said metal nanoparticle-nucleic acid composite. ---.

Claim Rejections - 35 USC § 112

Claims 25-47 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 25 (line 9) and claim 40 (line 10) are unclear by requiring the conjugate to be formed by metalation since the conjugate has previously been required to be formed by reacting a nucleic acid specific metal complex with a nucleic acid. It is suggested that line 9 of claim 25 and line 10 of claim 40 be amended by canceling "metalation of" and inserting --- reacting of the nucleic acid specific metal complex with ---.

In the last line of claim 26, there is not clear antecedent basis for "said nucleic specific metal complex". It is suggested that --- acid --- be inserted after "nucleic".

Claim 29 is unclear by reciting "metal complexes with attached or integrated nucleic acid interacting groups" (bridging lines 3 and 4) as an alternative to the specific metal complexes in lines 2 and 3, since the specific metal complexes contain nucleic acid interacting groups. Additionally, it is uncertain as to the difference in attached and integrated nucleic acid interacting groups. It is suggested that claim 29 be amended by changing the comma in line 3 to --- and --, and canceling "and metal complexes with attached or integrated nucleic acid interacting groups".

Dependent claim 35 is confusing and unclear by requiring treating metal nanoparticles within the conjugate since in claim 25 the metal nanoparticle-nucleic acid composite contains the metal nanoparticle.

In line 8 of claim 40, "nanoparticle" should be changed to --- metal nanoparticle of the composite --- to be clear as to the nanoparticle referred to. This change should also be made in line 1 of claims 33, 38 and 46. Additionally, in line 1 of claims 37 and 38, there is not clear antecedent basis for "the metal nanoparticles" since the composite does not require plural nanoparticles. In line 1 of claim 37, "the" should be deleted, and in claim 38 "the metal nanoparticles are" should be changed to --- metal nanoparticle of the composite --- as suggested above.

Claim 40 is unclear in line 9 by requiring "combinations or alloys" of the metals as being members of the Markush group since a combination of the metals is inherently an alloy, or the converse. It

is uncertain how the combination and alloy differ. It is suggested that "combinations or" or "or alloys" be deleted.

Claim 40 is confusing by being unclear as to when in the process the nanowire is produced. In line 9, it is suggested that --- to produce said nanowire --- be inserted after "thereof".

Dependent claim 41 is confusing and unclear by requiring the nanowire to comprise the composite since this is already required in claim 40. Aditionally, "composite which do or do" is grammatically incorrect, and there is not clear antecedent basis for "the nucleic acid strand" in line 4.

Claim 46 is unclear how it further limits claim 33 since the combination of metals in claim 33 is inherently an alloy. It is not seen how the combination cannot be an alloy, or the converse. It is suggested claim 46 be deleted or made dependent on another claim dependent on claim 25.

Response to Arguments

While amendments have obviated some indefiniteness in the claims, the claims are still indefinite for reasons set forth above.

Claim Rejections - 35 USC § 103

Claims 25-31 and 33-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pompe et al (AR) in view of Singh et al (5,560,960) and Richter et al (AQ) for reasons in the previous office action of 9/8/04, and for reasons herein.

The claims are drawn to a process of producing a metal nanoparticle-nucleic composite by reacting a nucleic acid with a metal complex to produce a metal complex-nucleic acid conjugate by metalation of bases and/or binding through an interactive group, removing non-conjugated byproducts, and reacting the conjugate with a reducing agent to produce the metal nanoparticle-nucleic acid composite. The metal nanoparticle of the composite is catalytically active towards electroless metallisation. Also claimed is a metal nanoparticle-nucleic acid composite resulting from the process, a process of making a nanowire by treating the composite by electroless deposition of metal, a nanowire resulting from the process, and a network or electronic circuit containing the nanowire.

Pompe et al disclose (page 1090, left col, second full paragraph) that Pt(II) and Pd(II) complexes such as cis-diamminedichloroplatinum attach to DNA bases to form stable monofunctional and bifunctional adducts. Further disclosed (third full paragraph of the left col) is that the Pt-DNA bond is not broken during reduction, and that Pt(II) and Pd(II) complexes attached to DNA double chain can act as nucleation centers for the growth of metal clusters. Also disclosed is carrying out metallization of DNA by adding DNA to Pd salt solution followed by adding a reducing agent, and obtaining clusters on the DNA of 3 to 5 nm in diameter in a few seconds after adding the reducing agent (paragraph bridging the cols, page 1090).

Singh et al disclose (paragraph bridging cols 1 and 2) precipitating nanometer-sized metal particles from solution within

vesicles made from polymerizable phospholipids. Polymerized phospholipids are formed and added to a electroless plating solution. Before the electroless plating solution is added, palladium or platinum is provided on the inside surface of vesicles to function as a catalyst (col 3, lines 44-64). To insure that metal particles form only on the inside surface, any metal on the exterior surface of the vesicle is removed such as by using a chelating agent and gel filtering, or by passing the vesicles through an ion exchange column. Singh et al further disclose (col 5, line 18) using cobalt, nickel or iron when producing metal nanoparticles by electroless plating.

Richter et al disclose (page 508 and 510) metallization of DNA similar to Pompe et al and disclose formation of clusters of 1-5 nm diameter on DNA (page 508, left col, third full paragraph).

It would have been obvious to attach cis-diamminedichloroplatinum to DNA as disclosed by Pompe et al, and then use a reducing agent to obtain DNA containing attached platinum metal catalysis for use in electroless deposition of metal on the DNA as suggested by Singh et al subjecting vesicles containing Pd or Pt to electroless metal deposition and as suggested by Pompe et al carrying out metallization of DNA by treating a DNA solution with a Pd salt solution, and then adding a reducing agent to form metal clusters on the DNA. Removing any non-attached metal complex from the DNA before electroless metallization would have been obvious to prevent the non-attached metal complex from forming metal particles as suggested by Singh et al removing metal from the exterior of vesicles to prevent metal

particles from being formed on the vesicles exterior surface. The objective of Pompe et al is to obtain metal clusters on the DNA and not at other places, and to accomplish this one would obviously have to remove none attached metal complex before electroless metallization. Removing any non-conjugated by-products that are not a non-conjugated would have been obvious simply to prevent any possible inference with subsequent reactions. It would have been apparent form Richter et al that metal clusters of 1-5 nm diameter can be obtained, and it would have been obvious to produce clusters not thicker than DNA since this is an objective of Pompe et al (page 1090, left col, first full paragraph). Reacting DNA with cis-diamminedichloroplatinum as disclosed by Pompe et al followed by reducing as set forth above will inherently result in metallization of bases, and provide a metal nanoparticle active towards electroless metallization. When carrying out metallization of DNA as set forth above, it would have been obvious to form a nanowire since Pompe et al (page 1090, right col, lines 1-10) and Richter et al (paragraph bridging pages 508 and 509) obtain a nanowire. Using the nanowire in an electronic circuit would have been obvious since metal wires are conventionally used in such circuits. The metallization of Pompe et al and Richter et al is controlled since they disclose controlling the time of metallization to control the size of clusters. The use of cobalt, nickel or iron when producing metal nanoparticles by electroless plating as disclosed by Singh et al would have suggested using a electroless plating solution as in claim 38.

Response to Arguments

Applicants urge that the references do not suggest removing non-conjugated metal complexes and/or non-conjugated by-products. However, claim 25 does not require non-conjugated metal complexes and/or non-conjugated by-products to be formed, and if not formed, removal is not carried out since claim 25 (line 6) and claim 40 (line 5) recite "any" after "removing". Pompe et al fail to disclose non-conjugated metal complexes and/or non-conjugated products being formed. If non-conjugated metal complexes and/or non-conjugated products are not formed in the claimed process, such complexes and/or products will not appear to be formed in the process of Pompe et al due to the similarity of the claimed process to that of Pompe et al. Even if the claims require non-conjugated metal complexes to be formed, the removal of these complexes would have been obvious to prevent metalation of non-conjugated metal complex as suggested by Singh et al as set forth above. The removal of non-conjugated by-products, if formed, that are not non-conjugated metal complexes as encompassed by the alternative language "and/or non-conjugated products" would have been obvious simply to prevent the inference of such by-products with subsequent reacting with a reducing agent.

Applicants urge that one would expect the behavior of palladium acetate to be similar to palladium chloride described by Dressick et al (copy supplied by applicants), and that the acetate is likely to hydrolyze when added to water. However, the chloride and acetate salts of palladium are quite different since chloride is inorganic and

acetate is organic having a much greater molecular weight. Thus, the behavior of palladium acetate cannot be predicted from the behavior of palladium chloride described by Dressick et al. Inadequate evidence is present to establish with certainty that palladium acetate hydroyzes in water before being mixed with DNA.

Applicants urge that Pompe et al and Richter et al use $Pd(CH_3COO)_2$ which is not a metal complex within the terms of the invention, and the $Pd(CH_3COO)_2$ does not bind to nucleic acid via metalation, which is direct covalent bonding between the metal center and a site on the nucleic acid. However, the present claims do not exclude $Pd(CH_3COO)_2$, and do not require direct covalent bonding. There is inadequate evidence to support applicants' assertion of $Pd(CH_3COO)_2$ in water forming clusters of oxygen-bridged Pd^{2+} ions of undefined compostion, size and charge. The specification does not teach that $Pd(CH_3COO)_2$ cannot be the complex used. Even if the claims are limited to cis-diamminedichloroplatinum, this complex is suggested by Pompe et al as an alternative to $Pd(CH_3COO)_2$. While Pompe et al does not give the specific details when using cis-diamminedichloroplatinum, such details would have been well within the skill of the art since attachment of this metal complex to DNA is previously known. Pompe et al disclose that Pt-DNA is formed which is stable to reduction, and that cis-diamminedichloroplatinum attaches to DNA bases to form stable monofunctinal and bi-functional adducts. There is nothing in the references to lead one to believe that after reacting DNA with cis-diamminedichloroplatinum, the resultant conjugate cannot be reduced as

when using $Pd(CH_3COO)_2$. When using cis-diamminedichloroplatinum or $Pd(CH_3COO)_2$ as suggested by Pompe et al, the Pd or Pt inherently acts as a nucleation center for the growth of clusters after attaching to DNA.

Applicants urge that the cluster diameter of 1-5 nm disclosed by Richter is a "wish" rather than actually obtained. However, there is seen nothing that would have prevented this diameter from being obtained since cluster size depends on the metallization time (Pompe et al (page 1090, right col, line 1). In any event, Pompe et al disclose obtaining a cluster diameter of 3-5 nm in a few seconds after adding the reducing agent. If the reaction is stopped immediately after adding the reducing agent, obviously the cluster size will be smaller than 3 nm such as 1 nm disclosed by Richter et al. The present claims fail to require a step or condition to produce a cluster diameter different than obtained by Pompe et al and Richter et al other than by stopping the reaction after adding the reducing agent. As noted above, the claims do not require producing non-conjugated metal complexes and/or non-conjugated by-products, and when not produced, their removal is not required. Additionally, when a non-conjugated by-product that is not a metal complex is formed as is encompassed by the claims, removing the by-product will not provide the result asserted for removing a non-conjugated metal complex since the by-product does not have to contain metal. In any event, there is inadequate evidence to support that removing non-conjugated metal complex, if formed, will affect cluster size as asserted, and this

result of removing non-conjugated metal complex is not disclosed in the specification. Undisclosed results may not be relied on to establish unobviousness. Even if removal of non-conjugated metal complex is convincingly established to have the asserted affect on cluster diameter, this will not establish that removal of by-products that are not a non-conjugated metal complex will have the same affect on cluster diameter. Furthermore, a cluster diameter that is slightly less than 3 nm as encompassed by claims 34, 39-42 and 47 can result from normal variations when producing a 3 nm diameter cluster. Moreover, a cluster size of 3 nm may not be visualized by atomic force microscopy, which is an alternative cluster size in claim 34, 39-42 and 47. Only claims 34, 39-42 and 47 limit cluster size, and the argument concerning cluster size is moot with respect to other claims.

Applicants urge that the claims require specific metalation of bases of the nucleic acid. However, this is not required since the claims encompass the alternative of binding of the nucleic acid specific metal complex through an interactive group. Moreover, "specific metalation of bases of the nucleic acid" does not have to require covalent bonding. Defining metalation in the specification does not limit the term to this definition in the claims. In Pompe et al and Richter et al, reacting the metal complex with DNA, inherently results in metalation within the scope of the claims. There is seen nothing prevent this from occurring.

Claim Rejections - 35 USC § 103

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 25-31 and 33-47 above, and further in view of Newsman et al (5,670,680) for reasons in the previous office action, and for reasons herein.

The claim requires a gaseous reducing agent.

Singh et al disclose using hydrogenation (col 4, line 57) for reducing metal ions to produce metals in a process of producing metal nanoparticles by electroless plating.

Newman et al disclose using hydrogen gas for hydrogenation in producing metal complexes.

It would have been obvious to use hydrogen gas as a reducing agent to reduce the metal of a conjugate of a metal complex and DNA disclosed by Pompe et al as suggested by Singh et al and Newman et al.

Response to Amendment

This rejection has not been separately traversed.

Double Patenting

Claims 25-47 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-22 and 24-35 of copending Application No. 10/210,812 in view of Singh et al.

The claims of the copending application require metallization of a nucleic acid to produce a metal nanoparticle-nucleic acid composite.

It would have been obvious in view of Singh et al for the type of reasons set forth above to remove non-conjugated metal complexes

and/or non-conjugated by-products, if formed, before treatment with a reducing agent in the process of the copending application claims for metallization of DNA. The presence of extraneous metal complex or other by-products will obviously be a contaminant that can interfere with subsequent reactions.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Response to Arguments

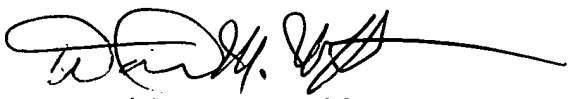
Applicants' urge that the copending application claims do not remove non-conjugated metal complex, and there is not motivation in the '812 application claims to combine its teachings with Singh et al. However, as noted above, the claims do not require removing non-conjugated metal complexes and/or non-conjugated products since none are required to be formed. Additionally, as set forth above, the removal of non-conjugated metal complex other than at a desired site for depositing metal is suggested by Singh et al, and the reason for removing this extraneous metal complex provided by Singh et al is motivation. As noted above, there is inadequate evidence and disclosure in the specification to support the asserted affect on cluster diameter from removing non-conjugated metal complex. Furthermore, even if removal of non-conjugated metal complex is convincingly established to have the asserted affect on cluster diameter, this will not establish that removal of by-products that are not a non-conjugated metal complex will have the same affect on cluster diameter.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David M. Naff whose telephone number is 571-272-0920. The examiner can normally be reached on Monday-Friday 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mike Wityshyn can be reached on 571-272-0926. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



David M. Naff
Primary Examiner
Art Unit 1651

DMN
4/12/05